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## FEMUR FIXTURE FOR A HIP-JOINT PROSTHESIS

### Field of the Invention

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The present invention relates to a femur fixture for a hip-joint prosthesis comprising an intraosseous anchoring structure of a generally circular cross-section adapted for screwing laterally into a complementary bore drilled laterally into the neck of a femur after resection of the femur head to an anchored position.

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### Background of the Invention

A femur fixture of the aforementioned type is disclosed in Applicant's prior International patent application publication WO93/16663<sup>A61F 2/38</sup>. In this femur fixture the intraosseous structure has a screw threaded cylindrical section at the proximal end. The use of a cylindrical proximal section in the intraosseous structure of the femur fixture of WO93/16663 enables the threads thereon to engage with the cortex of the femur neck and increase the fixation strength of the femur fixture in the femur. However, the threads at the terminal proximal portion of the cylindrical section do not register in the medial cortex of the femur neck at the resected surface. This is due to the cortex of the femur neck flaring outwardly adjacent the resected surface.

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This lack of loading of the cortex at the resected surface of the femur by the intraosseous anchoring structure of the femur fixture can lead to bone resorption at the resected surface. This situation is not able to be simply addressed by increasing the diameter of the cylindrical proximal section of the intraosseous anchoring structure of the WO93/16663 femur fixture because this would result in the threads of the cylindrical proximal section puncturing the cortex in the body of

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the femur neck or being dangerously close to puncturing the cortex due to the trumpet-like shape of the cortex in the femur neck.

The aim of the present invention is to address this drawback in the prior art femur  
5 fixture.

### Summary of the Invention

According to the present invention there is provided a femur fixture for a hip-joint  
10 prosthesis comprising an intraosseous anchoring structure of a generally circular cross-section for screwing laterally into a complementary bore drilled laterally into the neck of a femur after resection of the femur head to an anchored position in which the intraosseous anchoring structure has a proximal end, a distal end, a relatively short frusto-conical section at the proximal end and a cylindrical section  
15 having a screw thread profile thereon which extends towards the distal end from the frusto-conical section, the frusto-conical and cylindrical sections each being dimensioned so as to bear against the cortex of the femur neck when the intraosseous anchoring structure is in the anchored position. The relatively short frusto-conical section at the proximal end of the intraosseous anchoring structure  
20 thus loads the cortex of the femur neck adjacent the resected surface and the cylindrical section loads the cortex in the body of the femur neck.

The frusto-conical section may have a flank angle in the range of 8-15°, preferably in the range 10-12 °.

25 In an embodiment of the invention such as the one hereinafter to be described the frusto-conical section has an axial extent in the range of 5-10 mm. Preferably, the axial extent is approximately 8 mm.

In an embodiment of the invention such as the one hereinafter to be described the frusto-conical section has a proximal diameter in the range of 18-30 mm.

5 In an embodiment of the invention such as the one hereinafter to be described the frusto-conical section has a roughened outer surface. This improves the integration of the frusto-conical section with the cortex (termed "osseointegration" in the art). The roughening may be achieved by grit blasting, etching or machining or a combination of one or more of these roughening techniques.

10 Another way of roughening the frusto-conical section is to form the frusto-conical section with a screw thread profile. For simplicity, the screw thread profile can be formed by the turns of one or more screw threads. Alternately, the screw thread profile may be formed by circumferential lines of beads. The screw thread profile can be formed in the same manner on the cylindrical section.

15 In an embodiment of the invention such as the one hereinafter to be described the frusto-conical section has a screw thread profile of a height less than the screw thread profile of the cylindrical section. Preferably, the height of the screw thread profile on the frusto-conical section is no greater than 0.3 mm (microthreads),  
20 more preferably in the range 0.1-0.25 mm and even more preferably approximately 0.1 mm.

25 According to the present invention there is further provided a set of femur fixtures according to the invention with the frusto-conical and cylindrical sections of each fixture in the set having different dimensions whereby the fixture in the set having the frusto-conical and cylindrical sections of correct size for abutting the cortex of the femur neck of a patient can be selected for use in that patient.

An exemplary embodiment of the invention will now be described with reference to the accompanying Figures of drawings.

Brief Description of the Accompanying Figures of Drawings

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Figure 1 is a side view of a femur fixture for a hip-joint prosthesis in accordance with the invention.

Figure 2 is a perspective view from above of the femur fixture.

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Description of Exemplary Embodiment

The Figures of drawings show a femur fixture 1 for a hip-joint prosthesis integrally formed from commercially pure titanium consisting of (i) an  
15 intraosseous anchoring section 3 of circular cross-section for insertion laterally into a bore hole of complementary profile drilled into the neck of a femur through a resected surface made by resection of the head of the femur, and (ii) a head section 5 which will protrude from the resected surface when the intraosseous anchoring section 3 is located in the bore for supporting a ball of the hip-joint prosthesis  
20 which interacts with the anatomical acetabular cavity or an acetabular part of the hip-joint prosthesis where a total hip-joint prosthesis is required.

The intraosseous anchoring section 3 has proximal and distal cylindrical portions 11, 13 of different outer diameter. The diameter of the proximal cylindrical  
25 portion 11 is greater than that of the distal cylindrical portion 13 and a frusto-conical connecting portion 15 connects the proximal and distal cylindrical portions 11, 13 to one another. The intraosseous anchoring section 3 further has a tapered terminal distal portion 9 contiguous with the distal cylindrical portion 13 and a

frusto-conical terminal proximal portion 18 which connects the proximal cylindrical portion 11 to the head section 5.

5 The outer surfaces of the proximal and distal cylindrical portions 11, 13 are each provided with screw threads (not shown) of the same pitch and height with the major diameters of the screw threads on the proximal and distal cylindrical portions 11, 13 being sized to be greater than the inner diameter of complementary cylindrical portions of the bore provided in the femur neck. Accordingly, the intraosseous anchoring section 3 is able to be anchored in the bore by screwing of  
10 the femur fixture 1 into the bore with the screw threads on the proximal and distal cylindrical portions 11, 13 threading into the bone tissue in the boundary wall of the bore.

The diameter of the proximal cylindrical portion 11 is in fact sized such that the  
15 threads thereon register in the cortex in the body of the femur neck, as outlined in WO93/16663. As a guide, the diameter of the proximal cylindrical portion is in the range 17-25 mm. The threads on the proximal cylindrical portion 11 are thus secured in the stronger cortical bone as opposed to the spongier cancellous bone thereby giving the femur fixture 1 greater fixation in the femur neck.

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The frusto-conical terminal proximal portion 18 also has threads thereon. The height of these threads is 0.1 mm (so-called microthreads) which is less than that of the threads on the proximal and distal cylindrical portions 11, 13. The frusto-conical terminal proximal portion 18 is sized so that the microthreads engage with  
25 the cortex of the femur neck at the resected surface. As a guide, the frusto-conical terminal proximal portion 18 may have a flank angle in the range 10-12°, an axial extent of 8 mm and a proximal diameter in the range of 20.6 – 28.6 mm.

It should also be added that the axial length of the intraosseous anchoring section 3 is such that in the anchored position of the intraosseous anchoring section the distal end thereof projects through the lateral cortex of the femur.

5 Bridging the boundaries between the proximal cylindrical portion 11 and the  
frusto-conical connecting portion 15 and the distal cylindrical portion 13 and the  
tapered terminal distal portion 9 are a series of equi-spaced, circumferentially-  
arranged cutting recesses or notches 14, 17 respectively which give the  
intraosseous anchoring section 3 self-tapping capacity. The cutting recesses 14  
10 which bridge the proximal cylindrical portion 11 and the frusto-conical connecting  
portion 15 each communicate with a channel 16 in the proximal cylindrical portion  
11 for autologous transplantation of the bone cut by the cutting recesses 14 as the  
femur fixture 1 is screwed into the bore in the femur neck, as detailed in  
WO97/25939.

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The head section 5 of the femur fixture 1 has a collar portion 27 which delimits the  
insertion of the intraosseous anchoring section 3 into the bore in the femur neck by  
abutting with the resected femur surface adjacent the opening to the bore and a  
frusto-conical portion 19 for the ball component of the hip-joint prosthesis to be  
20 mounted on.

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The surgical procedure described in WO93/16663 for implanting the femur fixture  
disclosed therein can be adapted for implantation of the femur fixture 1 and as  
such is incorporated herein by reference.

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The anchorage of the femur fixture 1 is solely reliant on the registration of the  
threads in the bone of the femur, principally the registration of the threads on the  
frusto-conical terminal proximal portion 18 and cylindrical portion 11 in the cortex  
of the femur neck and the registration of the threads on the distal cylindrical  
portion 13 in the lateral cortex of the femur. This is in distinction to femur fixtures

which rely on a thrust plate mechanism for their fixation, for example as in GB-A-2033755.

The femur fixture 1 herein described with reference to Figures 1 and 2 can be  
5 varied in numerous ways within the scope of the invention. For instance, the  
femur fixture 1, and in particular the intraosseous section 3, could be in the form  
of an assembly in which the component parts are assembled together prior to  
insertion thereof laterally into the bore as a one-piece structure, as disclosed in  
WO93/16663. The femur fixture 1 could also be made from any biocompatible  
10 material of strength sufficient to withstand the loads imposed upon it in situ.

It will be appreciated that the invention has been described with reference to an  
exemplary embodiment and that the invention can be varied in many different  
ways within the scope of the appended claims. It will further be appreciated that  
15 the use in the appended claims of reference numerals from the Figures of  
drawings is for the purposes of illustration and not to be construed as having a  
limiting effect on the claims.



### Claims

1. A femur fixture (1) for a hip-joint prosthesis comprising an intraosseous anchoring structure (3) of a generally circular cross-section for screwing laterally  
5 into a complementary bore drilled laterally into the neck of a femur after resection of the femur head to an anchored position, the intraosseous anchoring structure having a proximal end, a distal end, a relatively short frusto-conical section (18) at the proximal end and a cylindrical section (11) having a screw thread profile thereon which extends towards the distal end from the frusto-conical section, the  
10 frusto-conical and cylindrical sections each being dimensioned so as to bear against the cortex of the femur neck when the intraosseous anchoring structure is in the anchored position.
2. A femur fixture as claimed in claim 1, wherein the frusto-conical section  
15 has a flank angle in the range of 8-15°, preferably in the range 10-12 °.
3. A femur fixture as claimed in claim 1 or 2, wherein the frusto-conical section has an axial extent in the range of 5-10 mm, preferably approximately 8 mm.  
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4. A femur fixture as claimed in any one of the preceding claims, wherein the frusto-conical section has a proximal diameter in the range of 18-30 mm.
5. A femur fixture as claimed in any one of the preceding claims, wherein  
25 the frusto-conical section has a roughened outer surface.
6. A femur fixture as claimed in claim 5, wherein the frusto-conical section has a screw thread profile.

7. A femur fixture as claimed in claim 6, wherein the frusto-conical section has a screw thread profile of height less than the screw thread profile of the cylindrical section.
- 5 8. A femur fixture as claimed in claim 6 or 7, wherein the height of the screw thread profile on the frusto-conical section is no greater than 0.3 mm, preferably in the range 0.1-0.25 mm and even more preferably approximately 0.1 mm.
9. A femur fixture as claimed in claim 6, 7 or 8, wherein the screw thread  
10 profile on the frusto-conical section is formed by the turns of one or more screw threads.
10. A set of femur fixtures according to any one of the preceding claims, wherein the frusto-conical and cylindrical sections of each fixture in the set have  
15 different dimensions whereby the fixture in the set having the frusto-conical and cylindrical sections of correct size for abutting the cortex of the femur neck of a patient can be selected for use in that patient.
11. A femur fixture for a hip-joint prosthesis substantially as herein described  
20 with reference to and as illustrated by the accompanying Figures of drawings.

ABSTRACTA Femur Fixture for a Hip-Joint Prosthesis

5 A femur fixture (1) for a hip-joint prosthesis comprising an intraosseous  
anchoring structure (3) of a generally circular cross-section for screwing laterally  
into a complementary bore drilled laterally into the neck of a femur after resection  
of the femur head to an anchored position, the intraosseous anchoring structure  
having a proximal end, a distal end, a relatively short frusto-conical section (18) at  
10 the proximal end and a cylindrical section (11) having a screw thread profile  
thereon which extends towards the distal end from the frusto-conical section, the  
frusto-conical and cylindrical sections each being dimensioned so as to bear  
against the cortex of the femur neck when the intraosseous anchoring structure is  
in the anchored position.

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(Figure 1)

